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ABSTRACT

In elementary economics courses students are often introduced to the basic concepts of macroeconomics through very simplified static models, and the concept of a macroeconomic equilibrium is generally explained with the help of an aggregate demand/aggregate supply (AD/AS) model and an income/expenditure model (via the Keynesian cross diagram). Although the AD/AS model does not provide a perfect way to explain the adjustment processes that lead to a new equilibrium national income after a change in spending, it is, in its simplicity, nonetheless a very useful pedagogical tool. The usefulness of the Keynesian cross diagram, however, is highly overrated. Its extensive coverage in introductory economics textbooks is not warranted since it does not seem to contribute significantly to undergraduates' general understanding of economic reasoning. While the chain reaction process of the expenditure multiplier is generally understood intuitively when it is explained in plain English with the help of a real life example, many introductory level students seem to experience considerable difficulty in understanding the diagramatical and mathematical analysis required by the Keynesian diagram. Heavy reliance on mathematical and diagramatical analysis at such an early stage probably does little more than contribute to the general confusion often experienced by beginning economics students. Simply supplementing the AD/AS framework, which is often presented before the Keynesian diagram, with a thorough discussion of the actual adjustment processes that take place when spending increases occur, will in most cases lead to a better comprehension of the material discussed than the use of the Keynesian diagram. The text includes four diagrams and several equations to illustrate the AD/AS framework. (PPB)

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The Keynesian Diagram: A Cross to Bear?

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INTRODUCTION:

In elementary economics courses students are often introduced to the basic concepts of macroeconomics through very simplified static models, and the concept of a macroeconomic equilibrium is generally explained with the help of an aggregate demand/aggregate supply model (via the AD-AS diagram) and an income/expenditure model (via the Keynesian cross diagram). Although the AD-AS model does not provide a perfect way to explain the adjustment processes that lead to a new equilibrium national income after a change in spending, it is, in its simplicity, nontheless a very useful pedagogical tool that can incorporate many alternative theories and concepts. The usefulness of the Keynesian cross diagram, however, is highly overrated, and it is this author's belief that its extensive coverage in introductory economics textbooks is not warranted since it does not seem to contribute significantly to undergraduates' general understanding of economic reasoning.

Economics textbooks use the Keynesian diagram to introduce students to the concept of the expenditure multiplier and to show the effects of spending changes on national income. But while the chain reaction process of the expenditure multiplier is generally understood intuitively when it is explained in plain English with the help of a real life example, many introductory level students seem to experience considerable difficulty in understanding the diagramatical and mathematical analysis required by the Keynesian diagram.

The Keynesian diagram as used in many introductory economics textbooks offers relatively little to enhance the average student's intuitive reasoning ability or understanding of macroeconomics. Instead it serves primarily to sharpen students' skills in linear algebra and geometry. While such skills may be needed for a better understanding of some of the material introduced later on, heavy reliance on mathematical and diagramatical analysis at such an early stage probably does little more than contribute to the general confusion often experienced by beginning students of economics.

This paper looks at the different ways in which macroeconomic textbooks use the Keynesian diagram to introduce students to economic modelling and points out inaccuracies and inefficiencies in the methodology that contribute to the difficulties experienced by beginning students in economics. It also asks the question: How important is it for the average student in an introductory macroeconomics class to understand the workings of the Keynesian diagram? If it is not the concept of the multiplier but rather the way in which the Keynesian diagram is used that causes so much confusion, then why not look for other, more effective pedagogical tools?

Common Misconceptions

Since there is a large difference between macroeconomic theory as it is taught in the classroom and its real world applications, beginning students often have a very unrealistic impression of how macroeconomics works in practice. In particular the use of the Keynesian diagram often gives students an inaccurate perception of the actual size of the expenditure

multiplier and the amount of time it takes for policy changes to affect national income.

Values of the multiplier that exist in students' minds often far exceed any values established by reputable economic studies. Most students will remember 1/mps = 1/(1-mpc) as the formula for the multiplier, since this formula is continually stressed early in introductory textbooks and is not revised until much later when the concept of built-in stabilizers (mostly in form of income taxes) is introduced. If students combine this with a reasonable estimate of the mpc as falling between .8 and .9, they come up with the size of the multiplier as being between 5 and 10.

No matter how often one points out in class that the size of the multiplier is actually determined by the specific model under discussion (which means that its size varies not only with the size of the marginal propensity to consume but also with the marginal income tax rate, the marginal propensity to import, or any other factor that provides built-in stability), such inaccurate perceptions persist.

These misconceptions could easily be avoided if textbooks immediately stressed that the form of the intended spending line can always be reduced to

$$\text{int.Sp.} = C + I + G + NX = A + b*Y$$

where A is the vertical intercept (autonomous spending) and b is the slope of the intended spending line (i.e., the [C+I+G+NX]-line). Then, by setting actual income equal to intended spending i.e., Y = int.Sp., the equilibrium level of national income Y can be calculated as

$$Y = A + b*Y \quad ==> \quad Y = [1/(1-b)]*A$$

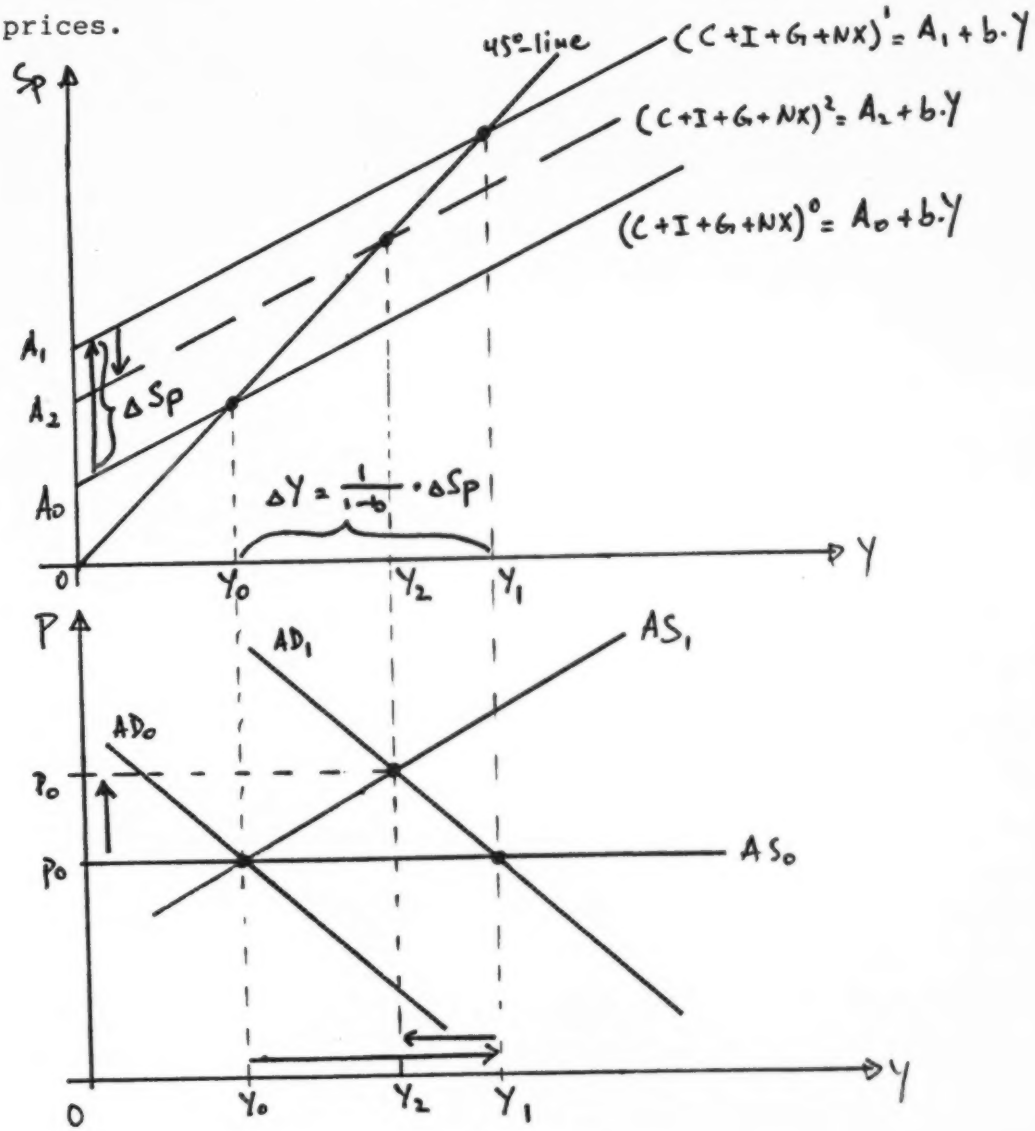
The formula for the expenditure multiplier is 1/(1-b) and in a simple case that incorporates income taxation with a tax rate t, we get b = c*(1-t). Students can clearly see that the multiplier increases with an increase in the marginal propensity to consume and decreases with an increase in the income tax rate or that it changes with any other factor that may be introduced and that affects b in any way.

It should be noted that the expression "intended spending" rather than "aggregate demand" for the [C+I+G+NX]-line in the Keynesian diagram is to be preferred. Why is this distinction important? For one, it avoids confusion with the downwards sloping aggregate demand curve in the AD-AS diagram. Even though students should realize that the vertical axis is labeled differently in each of these graphs, there are always a few students who will later draw an upwards sloping AD-curve in the AD-AS diagram. It has been my observation that this mistake is more prevalent in courses in which the textbook being used calls the [C+I+G+NX]-line aggregate demand rather than intended spending. Another reason to stress this difference is that a change in intended spending (the [C+I+G+NX]-line) is of a different magnitude than a change in aggregate demand (the AD-curve). If, as is the case in the Keynesian diagram, prices and interest rates are assumed to be constant, i.e., if a horizontal AS-curve is assumed, then a change in intended spending by (ΔSp) causes a shift in the AD-curve by (1/[1-b])*(ΔSp), i.e., the multiplier times the change in autonomous spending.

Confusion is intensified if the terms "inflationary gap" and "recessionary gap" are used for the vertical difference between the intended spending line (the [C+I+G+NX]-line) and the 45-degree line. This vertical distance represents the change in intended spending that is needed to change actual income (via the multiplier process) to the full-employment level of income. However, the GNP-gap (defined as the difference between potential GNP and actual GNP) is represented by the horizontal difference between the level of actual income and the level of full employment income. (In an AD-AS diagram actual income is determined by a short-run equilibrium, i.e., the intersection between the AD-curve and an upwards sloping AS-curve, whereas full employment income is determined by a long-run equilibrium, i.e., the intersection between the AD-curve and the vertical AS-curve.)

When the Keynesian diagram is presented, it is helpful to always draw an AD-AS diagram underneath it. As long as prices and interest rates are assumed to be constant, we have a horizontal AS-curve, and one can clearly see that a change in intended spending will cause a much larger change in aggregate demand and thus national income. If one now allows for prices and

interest rates to vary, we have an upwards sloping AS-curve, and one can immediately emphasize that the actual effect of an intended spending change on national income (the multiplier effect) is significantly reduced through the the real balance effect, i.e., an increase in prices.



Deriving Aggregate Demand

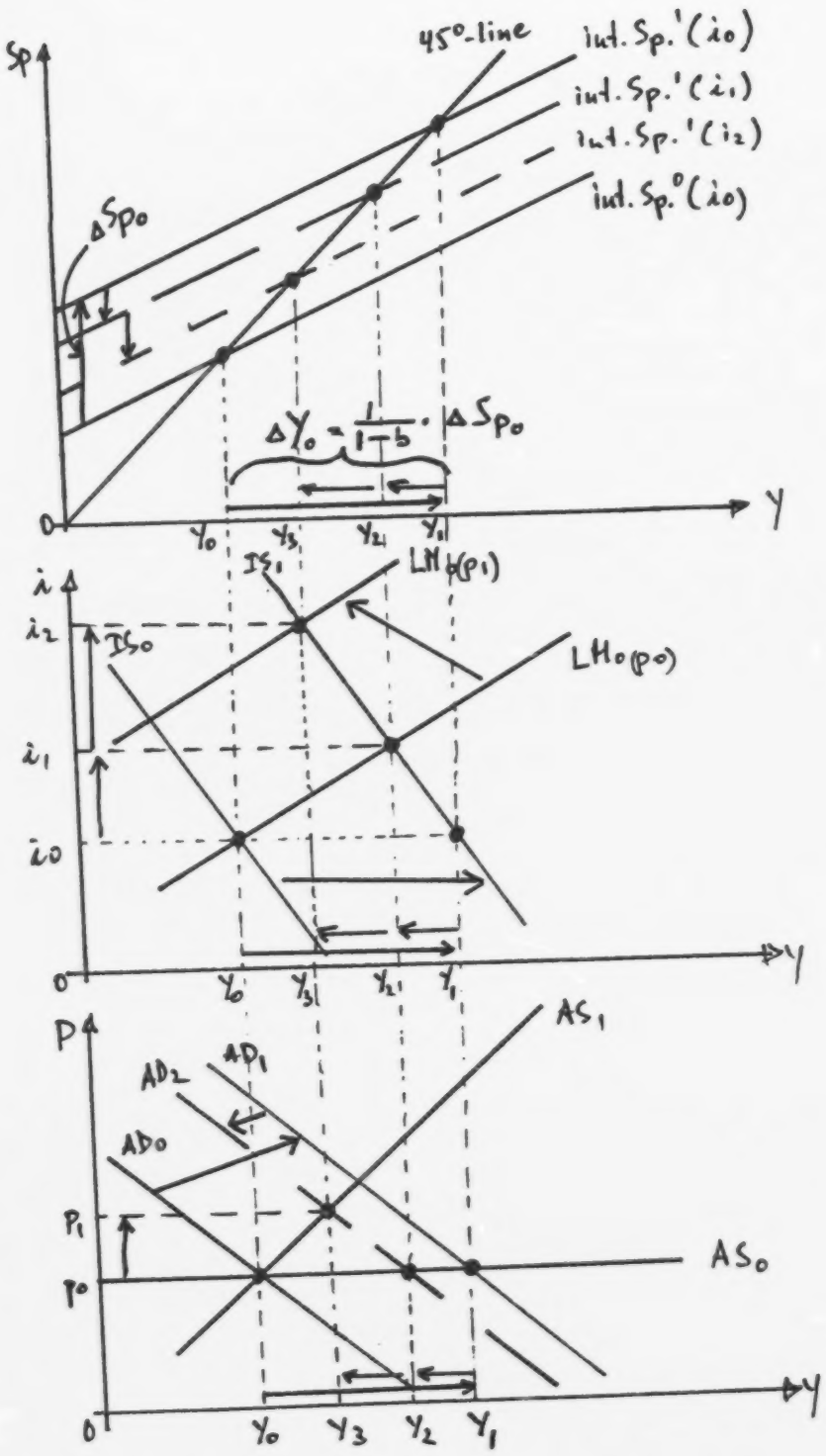
Most introductory macroeconomics textbooks first introduce students to a single market equilibrium where relative prices are important (via the D-S diagram), and then move on immediately to a general macroeconomic equilibrium that relates total output to the average price level (via the AD-AS diagram). But when the workings of the Keynesian diagram are discussed after the AD-AS diagram has been introduced, students have to step back from a model in which interest rates and prices can vary to a model in which interest rates and prices are assumed to be fixed. This approach not only seems unproductive but often also creates misconceptions in students' minds when the Keynesian diagram is then used to explain why the AD-curve is downwards sloped.

When the AD-AS diagram is first introduced, the downwards slope of the AD-curve is often correctly identified as the result of a combination of effects that occur as a result of a change in the average price level. There is a change in consumption (due to the wealth effect), a change in investment (due to a change in interest rates caused by the real balance effect), a change in net exports (due to relative price changes of

imports and exports) or even a change in the size of real government spending (due to the fact that government spending is fixed in nominal and not real terms). Later on, however, when the AD-curve is derived from the Keynesian diagram many textbooks (probably for the sake of simplicity) provide only one main reason for a reduction in intended spending as a response to price changes. Some only discuss the real balance effect (an increase in price causes a reduction in real money supply and thus an increase in interest rates that will reduce investment spending), while others concentrate on the wealth effect (an increase in the average price level leads to a reduction in real wealth, which negatively affects consumption and thus intended spending). Especially the latter approach gives students the impression that the wealth effect is very important while, in actuality, it tends to be relatively small.

Although this is generally not discussed in introductory textbooks, it is worth noting here that intermediate macroeconomic textbooks tend to use the Keynesian diagram to derive the IS-curve and then use the IS-LM framework to derive the AD-curve, an approach that is not very compatible with the approach taken in introductory textbooks which derive the AD-curve directly

from the Keynesian diagram. One can easily see this by combining the Keynesian diagram, the IS-LM diagram and the AD-AS diagram. For example, an increase in government spending by (ΔG) causes an increase in national income in the Keynesian diagram of [1/(1-b)]*(ΔG), which means that the IS-curve shifts by [(1/(1-b)]*(ΔG). The increase in income causes excess demand for money, interest rates begin to rise and some private spending is crowded out (the crowding out effect). Thus the increase in income necessary to reach a new equilibrium in the IS-LM diagram is actually less than [1/(1-b)]*(ΔG), which means that the AD-curve shifts by less than [(1/(1-b)]*(ΔG) and the [C+I+G+NX]-line has to shift down again.

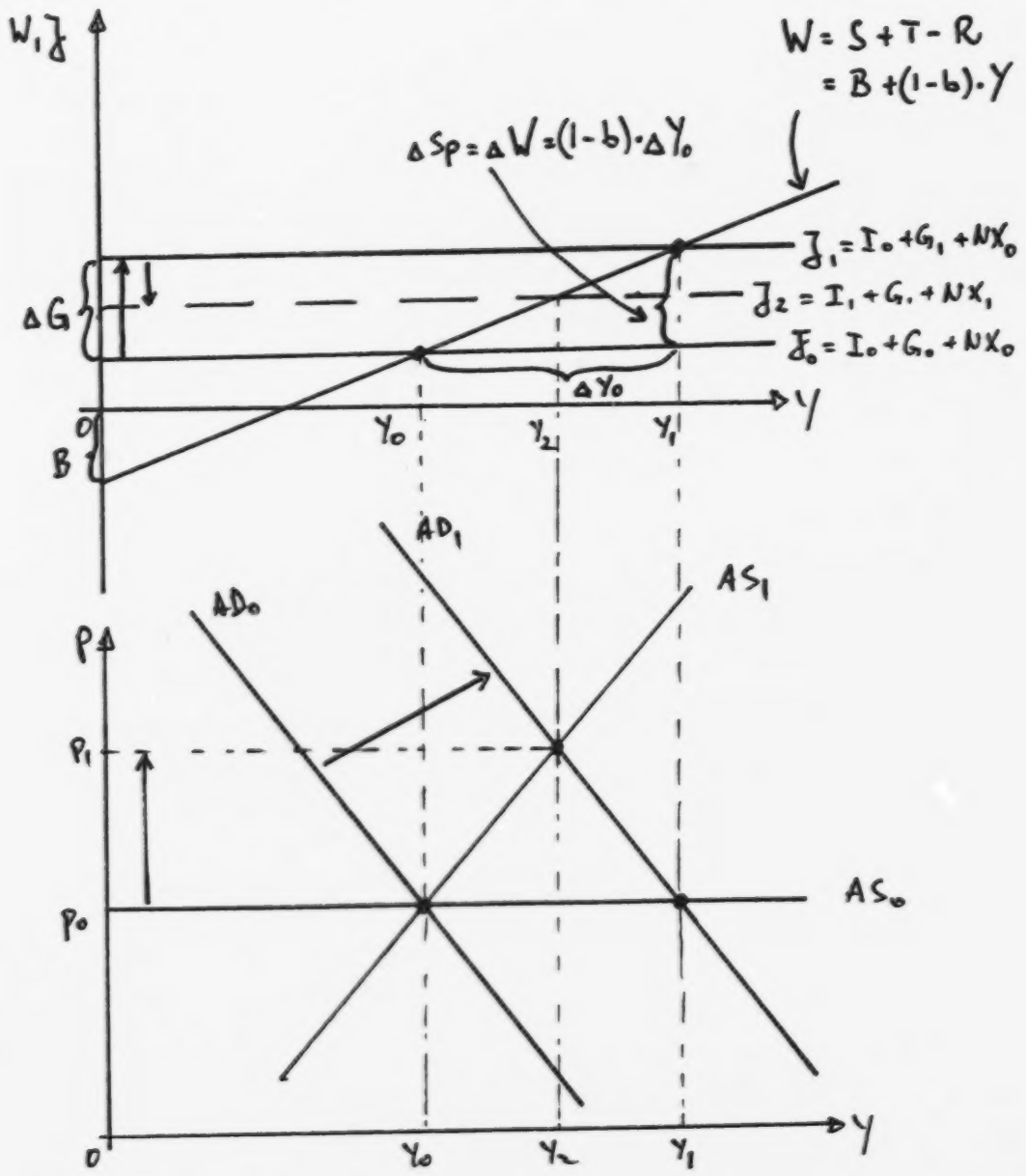

Sp
45°-line
ind. Sp.¹(i₀)
ind. Sp.¹(i₁)
ind. Sp.¹(i₂)
ind. Sp.⁰(i₀)
ΔSp₀
ΔY₀ = 1/(1−b) · ΔSp₀
0
Y₀
Y₃
Y₂
Y₁
Y
i
IS₁
LM₁(P₁)
i₂
IS₀
LM₀(P₀)
i₁
i₀
P
AD₂
AD₁
AD₀
AS₁
P₁
P₀
AS₀

To relate the IS-LM framework to the AD-AS framework, one now has to explain the price adjustment, that is, the real balance effect. Due to the shift in the AD-curve there is excess demand for goods and services and prices will increase, i.e., we have a movement along the new AD-curve to the new macro-equilibrium. Real money supply decreases with the increase in the price level, and the LM-curve shifts to the left. The intended spending line thus has to shift down even further due to a decrease in private spending (consumption, investment and net exports). In the IS-LM framework the actual shift of the AD-curve is of a different magnitude than the shift that takes place when just the Keynesian diagram and the AD-AS diagram are combined. Trying to explain the AD-shift resulting from the IS-LM framework as a combination of two shifts, one to the right by $[1/(1-b)]*(\Delta G)$, and one the left by $[1/(1-b)]*(\Delta I)$, however, is far from satisfactory.

The Withdrawal-Inections Diagram

To avoid such discrepancies, it may be preferable to forego the derivation of the AD-curve from the Keynesian diagram altogether and just use the AD-AS framework as originally introduced. Any concepts that are generally explained with the help of the Keynesian diagram can just as well -- if not better -- be explained with the help of another diagram: the so-called withdrawals-injections diagram. Use of this diagram avoids altogether any confusion between aggregate demand and intended spending.

For the graphical analysis and the derivation of the expenditure multiplier one can initially, for simplicity, assume that injections J = (I+G+NX) are constant. Then the formula for the expenditure multiplier can easily be derived from the fact that the slope of the withdrawal line, i.e., the W = [S+T-R]-line, is equal to 1-b. If the injections-line shifts by (ΔSp), the effect on Y is [1/(1-b)]*(ΔSp), since (ΔSp) = (ΔW) and (ΔW)/(ΔY) = (1-b), assuming constant prices and interest rates. In a model where prices and interest rates can change (an upwards sloping AS-curve), the injections-line will have to shift down somewhat again, due to the real balance effect mentioned previously.


W, J
W = S + T - R
= B + (1-b)·Y
ΔSp = ΔW = (1-b)·ΔY₀
J₁ = I₀ + G₁ + NX₀
J₂ = I₁ + G₀ + NX₁
J₀ = I₀ + G₀ + NX₀
ΔG
ΔY₀
Y
O
B
Y₀
Y₂
Y₁
AD₁
AD₀
AS₁
AS₀
P
P₁
P₀
O
Y₀
Y₂
Y₁
Y

Similar advantages exist when the witdrawals-injections diagram is used to instaed of the Keynesian diagram explain the concepts of the so-called "balanced budget theorem" and the so-called "paradox of thrift."

In addition, this diagram allows for the introduction of more 'real world' economics at a relatively early stage in the course. The following simple explanation will illustrate the advantages of such a method:

From the definition of disposable income (Yd) we get

$$Yd = C + S \quad \text{and} \quad Yd = Y - T + R \quad \Rightarrow \quad Y = C + S + T - R$$

$$\text{since} \quad Y = C + I + G + NX \quad \Rightarrow \quad S + T - R = I + G + NX$$

that is, withdrawals are equal to injections. Note that transfers payments (R) actually should be treated as an injection, and net exports (NX) should preferably be separated into exports (X), which is an injection and imports (M), which is a withdrawal. But since students should already have been exposed to this equality when dealing with national income accounting or a circular

flow diagram, this way of stating this equality is to be preferred.

The above equation, if manipulated into another:

$$S + T - R = I + G + NX \implies S - I = -(T-G-R) - (-NX)$$

is more meaningful to students, since it states that the difference between savings (S) and investment (I) is equal to the difference between the budget deficit and the trade deficit. Now it is easy to show that if savings stays relatively constant, any increase in the budget deficit must lead to a decrease in the level of investment spending (crowding out) and/or an increase in the trade deficit (the latter being caused by an inflow of foreign funds to finance part of the budget deficit).

This explanation can not only be used to explain the development of the "twin deficits" in the early 1980's, but also helps explain why the decrease in the size of the budget deficit in the mid-1980's was not accompanied by a decrease in the trade deficit, by pointing out that savings must have fallen (which actually occurred). It also explains the fact that a country like Italy, for example, that has a proportionally higher budget deficit than the U.S. is not plagued by a trade deficit, since

its savings rate is much higher. In other words, with the help of a few simple equations that are generally well understood by students, one can at a relatively early stage touch upon some very complex macroeconomic issues in our current history.

The Dynamic Multiplier

Even though one may prefer the withdrawals-injections diagram over the Keynesian diagram for a diagramatical analysis, the latter actually serves better to explain the concept of the so-called dynamic multiplier. Students often perceive the multiplier process as an immediate change from one equilibrium point to the next. It is, however, extremely important to stress the fact the full effect of the multiplier process is not felt until many time periods have passed. Thus, when shifting the intended spending line (the [C+I+G+NX]-line) by (ΔSp), the overall change on national income is really the sum of several smaller changes.

Using the concept of the slope, one can show that

$$\Delta Y = \Delta Y1 + \Delta Y2 + \Delta Y3 + \Delta Y4 + ... + \Delta Yn \quad ==>$$

$$(\Delta Y) = (\Delta Sp) + b*(\Delta Sp) + b^2*(\Delta Sp) + b^3*(\Delta Sp) + ...+ b^n*(\Delta Sp)$$

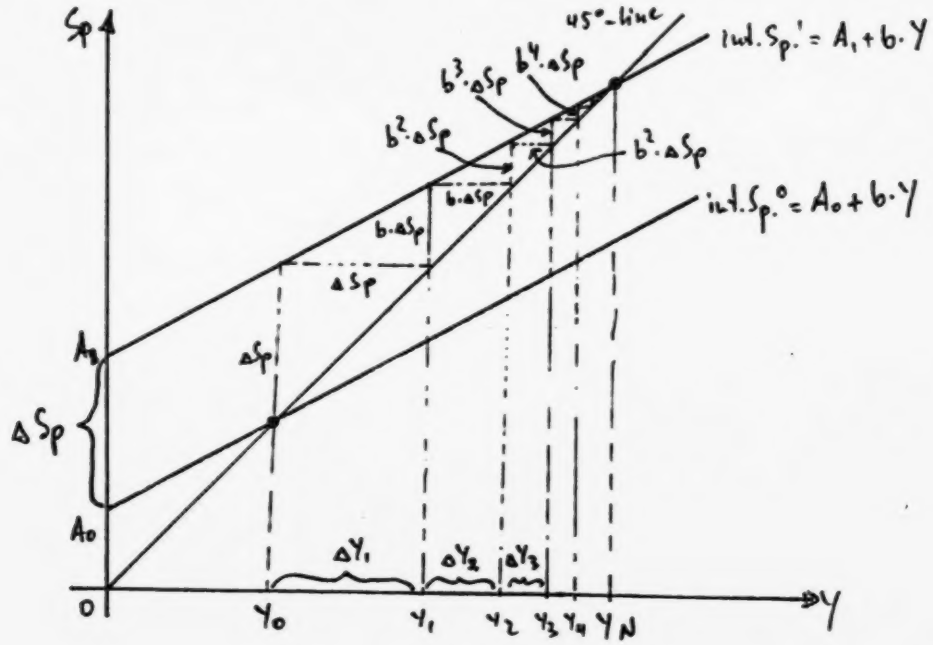
If one multiplies both sides of this equation by (-b), one gets

$$- b*(\Delta Y) = - b*(\Delta Sp) - b^2*(\Delta Sp) - b^3*(\Delta Sp) - ... - b^{n+1}*(\Delta Sp)$$

and if one adds the two equations together one gets

$$(\Delta Y) - b*(\Delta Y) = (\Delta Sp) - b^{n+1}*(\Delta Sp) \quad \text{and as } b^{n+1} \text{-->} 0$$

$$(1-b)*(\Delta Y) = (\Delta Sp) \quad ==> \quad (\Delta Y) = [1/(1-b)]*(\Delta Sp)$$



This graphical and mathematical derivation of the dynamic multiplier should be comprehensible for the average undergraduate economics student, especially if it is supplemented by a good "real life" example of the effects of a spending increase on national income. One useful example is to assume that everyone in this economy saves 10% of any additional income received and thus spends 90% of any additional income received. The process starts with a government employee receiving a $100 salary check, of which $90 are spent on clothes and $10 are saved. The department store owner then spends $81 on a restaurant meal and saves $9 dollars, the restaurant owner spends $72.90 on groceries and saves $8.10, and so forth. In this example, the size of the multiplier is 10, the overall effect on national income is

$$\Delta Y = 100 + 81 + 72.90 + ... = 1,000$$

and savings is increased by

$$\Delta S = 10 + 9 + 8.10 + ... = 100.$$

It might be sufficient to rely solely on this intuitive explanation of the multiplier concept that stresses the fact that this process is dynamic and that the size of the multiplier varies from model to model. Thus the example should be expanded to include income taxation (or any other built-in stabilizers) to show that the size of the expenditure multiplier is determined by a variety of factors, including (but not limited to) the marginal propensity to consume (or save) and the income tax rate. If graphical analysis is used, however, an approach incorporating the withdrawals-injections diagram in combination with the AD-AS diagram is to be preferred over the use of the Keynesian diagram, since the former lends itself so well to the discussion of important and interesting applied issues such as the relationship between savings, investment, the budget deficit and the trade deficit.

Conclusion:

Even though economic modelling is important in developing students' economic reasoning abilities, it seems more important to help students at the introductory stage to understand current events and the difficulties associated with forecasting possible effects of alternative stabilization policies. Instead of employing graphs that are incomprehensible to many students, real life examples should be introduced into the class room. Increasing students' general understanding of economic reasoning is preferable to sharpening their skills in linear algebra or geometry.

Introductory macroeconomic textbooks place great emphasis on the Keynesian cross diagram and a considerable amount of class time has to be devoted to explaining its main concepts. Such an effort seems unwarranted, since the discussion of an expenditure model in which prices and interest rates are assumed to be fixed adds relatively little to the average undergraduates' understanding of economic reasoning and instead may add to the general confusion experienced by beginning students. Simply supplementing the AD-AS framework, which is often presented before the Keynesian

diagram anyway, with a thorough discussion of the actual adjustment processes that take place when spending increases occur, will in most cases lead to a better comprehension of the material discussed than the use of the Keynesian diagram.

It is my hope that future textbook editions will put less emphasis on the use of Keynesian cross. The class time saved can be used for discussions of real world economics in a more complex framework making connections for students between the macroeconomic theory taught in the classroom and its real world applications.

Note: Throughout this paper I have referred to "economics textbooks" as a group and what I perceive to be their inefficiencies. Obviously not all the methods noted are used in all textbooks.